Claims

What is claimed is:

1. An apparatus for generating a periodically varying electrical signal for creating a periodically varying electrical field between electrodes of an ion mobility spectrometer, comprising:

an output port;

a first tuned circuit for being electrically coupled to an external power source and for, in isolation, providing a first periodically varying electrical signal having a first frequency, the first tuned circuit coupled to the output port for providing an output electrical signal having a component at the first frequency thereto; and,

a second tuned circuit for being electrically coupled to an external power source and for providing a second periodically varying electrical signal having a second frequency different from the first frequency, the second tuned circuit coupled to the first tuned circuit for varying the output electrical signal about the first periodically varying electrical signal.

2. An apparatus according to claim 1, wherein the first tuned circuit comprises:

at least a first inductor having a primary winding and a secondary winding;

a capacitive load coupled to the secondary winding of the at least a first inductor and including a first tunable capacitance and electrodes of an ion mobility spectrometer; and,

a load resistor coupled to the primary winding.

3. An apparatus according to claim 2, wherein the second tuned circuit comprises at least a second inductor having a primary winding and a secondary winding, and wherein the secondary winding of the at least a first inductor is electrically coupled to a center-tap of the secondary winding of the second inductor.

4. An apparatus according to claim 2, wherein the at least a first inductor comprises two inductors coupled in series one to the other.

5. An apparatus according to claim 4, wherein the second tuned circuit comprises two inductors coupled in series one to the other, and wherein the secondary winding of the at least a first inductor is electrically coupled to a center-tap between the two inductors of the second tuned circuit.

6. An apparatus according to claim 2, wherein the second tuned circuit comprises two inductors coupled in series one to the other, and wherein the secondary winding of the at least a first inductor is electrically coupled to a center-tap between the two inductors of the second tuned circuit.

7. An apparatus according to claim 2, wherein the load resistor is selected to ensure approximately sinusoidal variations in electrical currents in the primary winding.

8. An apparatus according to claim 7, wherein the load resistor is selected such that a desired voltage of the first periodically varying electrical signal is obtained with approximately minimum consumption of power from the external power source.

9. An apparatus according to claim 1, wherein the first frequency and the second frequency differ by a factor of substantially two.

10. An apparatus according to claim 1, comprising a pair of electrodes disposed for forming an analyzer region therebetween.

11. An apparatus according to claim 2, comprising switches electrically coupled to the apparatus for in a first switched mode providing current along a first direction through the primary winding of the at least a first inductor, and for in a second other switched mode providing current along a second other direction through the primary winding of the at least a first inductor.

12. An apparatus according to claim 3, comprising switches electrically coupled to the apparatus for in a first switched mode providing current along a first direction through the primary windings of each one of the at least a first inductor and the at

least a second inductor, and for in a second other switched mode providing current along a second other direction through the primary winding of each one of the at least a first inductor and the at least a second inductor.

13. An electromagnetic transformer comprising:

a secondary winding comprising a plurality of turns of a first wire wound defining a core and having an approximately uniform spacing between adjacent turns;

a first primary winding comprising at least one turn of a second wire wound around the core and spaced apart from both the core and the secondary winding; and,

a second primary winding comprising at least one turn of a third wire wound around the core in parallel with the first primary winding and spaced apart from both the core and the secondary winding.

14. An apparatus according to claim 13, wherein at least some of the core comprises a core material other than air.

15. An apparatus according to claim 14, wherein the turns of the first wire of the secondary winding are wound proximate the core material other than air.

16. An apparatus according to claim 14, wherein the core comprises a substantially toroid-shaped core having a gap.

17. An apparatus according to claim 14, wherein the core material has a magnetic permeability similar to the magnetic permeability of air.

18. An apparatus according to claim 15, wherein the turns of the first wire of the secondary winding are wound tightly around the core.

19. An apparatus according to claim 13, wherein the approximately uniform spacing between adjacent turns of the first wire of the secondary winding is approximately equal to the diameter of the first wire.

20. An apparatus according to claim 13, wherein the space between the first wire of the secondary winding and either one of the second wire of the first primary winding and the third wire of the second primary winding defines an air gap.

21. An apparatus according to claim 13, wherein the first wire of the secondary winding is wound around the core over a substantial portion of a length thereof between the first end and the second end.